SoftCOM 2012

20th International Conference on Software Telecomunications and Computer Networks
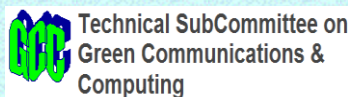
Proceedings of the 3rd Special session on green networking and computing

in the frame of IEEE *SoftCOM 2012* conference

September, 11 – 13, 2012, Split, Croatia

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In cooperation with:

Technical SubCommittee on Green Communications & Computing

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Organisers:

WELCOME

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SPECIAL SESSION CHAIRS MESSAGE

Foreword
The third Special session on green networking and computing was held in the frame of the 20th International Conference on Software, Telecommunications and Computer Networks. The jubilee 20th International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2012) was held in attractive ambience of the Radisson Blu Resort hotel, Split, Croatia, September 11 to 13, 2012. The Conference is organized by the University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture under the auspices of the Ministry of Science, Education and Sports. The Conference has been technically co-sponsored by the IEEE Communications Society (ComSoc). Researchers and experts from industry, research institutes and universities from 32 countries all around the world have submitted in total 186 papers for presentation at SoftCOM 2012

The Special session organizers are University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB) and Politecnico di Milano university, Department of electronics and informatics (DEI). The Special session is organized in cooperation with IEEE ComSoc Technical Subcommittee on Green Communications and Computing (TSCGCC). Furthermore, Special session is supported by the European Commission FP7 TREND (Towards Real Energy-efficient Network Design) project and the International Journal of Business Data Communications and Networking (IJBDCN).

In the frame of Special session, one plenary speech considering problems related to the energy consumption of telecommunication networks was held. In addition, one half-day tutorial focused on transition from energy-efficient networking to sustainable networking was organized. Ten accepted papers have been presented in the technical program of the Special session featuring one session dedicated to green networking and computing and the other to the mobile and wireless communications. Also, one presentation held by experts from company Nokia Siemens Networks Croatia on the topic considering cellular networks and energy-efficiency was organized in the frame of conference business forum.

We hope that readers of these proceedings will find the articles and presentations informative and that they will enjoy reading this feature topic devoted to exciting fast-evolving field of green networking and computing. We would like to thank all the authors who submitted articles to this Special session and to all presenters who give their presentations which significantly contribute to international affirmation of this Special session. Finally, we express our gratitude to all reviewers for their comments and valuable feedback on the submitted articles.

Special session Co-chairs

Atonio Capone

Josip Lorincz

PROCEEDINGS INFORMATION

Proceedings of the 3rd Special session on green networking and computing
2012 International Conference on Software, Telecommunications and Computer Networks

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INTERNATIONAL SPECIAL SESSION COMMITTEE

Special session co-chairs:
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and
Josip Lorincz
FESB, University of Split, Croatia

Committee members:
Honggang Zhang, *Zhejiang University, China*
Jinsong Wu, *Bell Laboratories, China*
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Lingjia Liu, *University of Kansas, USA*
Luca Chiaraviglio, *Politecnico di Torino, Italy*
Marco Ajmone Marsan, *Institute IMDEA Networks, Spain*
Marco Conti, *Institute for Informatics and Telematics, Italy*
Mario Pickavet, *Ghent University, Belgium*
Michela Meo, *Politecnico di Torino, Italy*
Ulrich Barth, *Alcatel-Lucent/ Bell Labs, Germany*

SPECIAL SESSION PROGRAM

Invited talk (opening ceremony):
TREND : The FP7 network of excellence on Green Networking
Prof. Marco Ajmone Marsan, Ph. D., Politecnico di Torino, Italy
September 12, 11:00-12:30, Grand ballroom, (Hotel Radisson Blu Resort, Split, Croatia)

Tutorial presentation:
From energy efficient networking to sustainable networking
Prof. Michela Meo, Ph. D., Politecnico di Torino, Italy
September 11, 10:30 – 12:00, Conference room Korčula, (Hotel Radisson Blu Resort, Split, Croatia)

Special session on green networking
Session chair: Josip Lorincz, Ph. D., University of Split, Croatia
September 12, 2012, 16:30 – 18:00, Conference room Brač, (Hotel Radisson Blu Resort, Split, Croatia)

Papers on green networking presented in:
Session on mobile and wireless communications I
Session Chair: Zoran Blažević, Ph. D. , University of Split, Croatia
September 11, 2012, 10:30 – 12:00, Conference room Hvar, (Hotel Radisson Blu Resort, Split, Croatia)

Business forum:
Nokia Siemens networks and energy efficiency
Presenters: Nives Sandri, Mr. Sc., Mr. Darko Giljević, Nokia Siemens Networks Croatia,
September 12, 2012, 16:00 – 16:30, Conference room Šolta, (Hotel Radisson Blu Resort, Split, Croatia)

Tracks

- ❑ *Plenary speech*
- ❑ *Tutorial*
- ❑ *Special Session on Green Networking*
- ❑ *Session on Mobile and Wireless Communications I*
- ❑ *Business forum*

Plenary speech

Marco Ajmone Marsan, *Politecnico di Torino, Italy*
Wednesday, September 12, 2012,11:00-12:30 (GRAND BALLROOM)

TREND: The FP7 Network of Excellence on Green Networking

Abstract: In this talk I will describe the problems related to the energy consumption of telecommunication networks, and the approaches for energy efficiency developed within the FP7 Network of Excellence TREND (Towards Real Energy-efficient Network Design). I will finally provide some details on savings made possible by adopting base station sleep modes in cellular networks.

Biography: Marco Ajmone Marsan is Professor of Telecommunications at the Politecnico di Torino in Italy, and Chief Researcher at the Institute IMDEA Networks in Spain. He was the Vice-Rector for Research, Innovation and Technology Transfer at the Politecnico di Torino from 2005 to 2009. From 2002 to 2007 he was the Director of the Institute for Electronics, Information and Telecommunications Engineering of the National Research Council. He is the Italian Delegate in the ERC Committee of the 7th Framework Programme of the EU. His main present research interest is in energy-efficient networking, and in the applications of ICT for energy efficiency.

Tutorial

Michela Meo, *Politecnico di Torino, Italy*
Tuesday, September 11, 2012, 10:30-12:00 (KORČULA))

From energy efficient networking to sustainable networking

Abstract: Energy efficient networking has become an hot topic in the last few years. In this tutorial, I will first motivate the interest and importance of this topic by presenting some data about energy consumption of network devices. Data will allow to identify the network segments that are the most energy hungry. The main approaches proposed in the literature for reducing network energy consumption will then be presented with particular attention to wireless networks. Finally, we will shift our attention from energy efficient networking to the new challenging topic of sustainable networking.

Biography: *Michela Meo received the Laurea degree in Electronics Engineering in 1993, and the Ph.D. degree in Electronic and Telecommunications Engineering in 1997, both from the Politecnico di Torino, Italy. Since November 1999, she is an Associate Professor at Politecnico di Torino. She co-authored more than 150 papers and edited six special issues of international journals. Her research interests are in the field of green networking, performance evaluation and modeling, traffic classification and characterization, P2P.*

SS1 - Special Session on Green Networking

Session Organizers: *Antonio Capone, Politecnico di Milano, Italy; Josip Lorincz, University of Split, Croatia*
Session Chair: *Josip Lorincz, University of Split, Croatia*

❑ **On the Effectiveness of Sleep Modes in Backbone Networks with Limited Configurations**
Luca Chiaraviglio (Politecnico di Torino, Italy); Antonio Cianfrani (University of Roma "La Sapienza", Italy)

❑ **Green Polymorphic Approach for Service Quality**
Fawaz AL-Hazemi (Korea Advanced Institute of Science and Technology, Korea)

❑ **Green Traffic Engineering for Future Core Networks**
George Athanasiou (KTH Royal Institute of Technology, Sweden); Carlo Fischione (KTH, Sweden)

❑ **Circuit Switching and Time-domain Optical Sub-wavelength Switching Technologies: Evaluations on the Power Consumption**
Edoardo Bonetto (Politecnico di Torino, Italy); Ahmed Triki (Orange Labs, Networks and Carriers, France); Esther Le Rouzic (Orange Labs, France); Bernard Arzur (Orange Labs, Networks and Carriers, France); Paulette Gavignet (Orange Labs, Networks and Carriers, France)

❑ **Introducing Fairness in Cooperation among Green Mobile Network Operators**
Leonardo Militano (Mediterranea University of Reggio Calabria, Italy); Antonella Molinaro (University "Mediterranea" of Reggio Calabria, Italy); Antonio Iera (University Mediterranea of Reggio Calabria, Italy); Ármin Petkovics (Budapest University of Technology and Economics, Hungary)

SS1 - Special Session on Green Networking

Session Organizers: *Antonio Capone, Politecnico di Milano, Italy; Josip Lorincz, University of Split, Croatia*
Session Chair: *Josip Lorincz, University of Split, Croatia*

❑ **Bit per Joule and Area Energy-efficiency of Heterogeneous Macro Base Station Sites**
Josip Lorincz (University of Split, Croatia); Nikola Dimitrov (University of Split, Croatia); Toncica Matijevic (University of Split, Croatia)

S5 - Mobile and Wireless Communications I

Session Chair: Zoran Blažević (University of Split, Croatia)

❑ **Energy Efficiency using Beamforming at the Base Station in UMTS and LTE**
Tiago Gonçalves (IST/IT - Technical University Lisbon, Portugal); Luis M. Correia (IST - Technical University Lisbon, Portugal); Filipe D. Cardoso (ESTSetubal/Polytechnic Institute of Setubal, Portugal)

❑ **MIMO Strategies for Energy Efficient Transmission in LTE Pico-cell Environments**
Filipe D. Cardoso (ESTSetubal/Polytechnic Institute of Setubal, Portugal); Rodolfo Torrea-Duran (IMEC, Belgium); Claude Desset (IMEC, Belgium); Luis M. Correia (IST - Technical University Lisbon, Portugal)

❑ **A PPAM technique for energy efficient UWB sensor Body Area Networks**
Giovanni Pelliccioni (Università Politecnica delle Marche, Italy); Fabrizio Borioni (Università Politecnica delle Marche, Italy); Ennio Gambi (Università Politecnica delle Marche, Italy); Susanna Spinsante (Università Politecnica delle Marche & ArieLAB Srl, Italy)

❑ **A Game Theoretic Approach to Power Trading in Cognitive Radio Systems**
Mahmoud Khasawneh (Concordia University, Canada); Anjali Agarwal (Concordia University, Canada); Nishith Goel (Cistel, Canada); Marzia Zaman (Cistel Technology Inc., Canada); Saed Alrabaee (Concordia University, Canada)

Business forum

Nives Sandri, *Nokia Siemens Networks, Croatia*
Darko Giljević, *Nokia Siemens Networks, Croatia*
Wednesday, September 12, 2012, 16:00-16:30 (ŠOLTA)

Nokia Siemens Networks and energy efficiency

Abstract: Using energy in efficient manner becomes true obligation in the overall efforts to ensure environment sustainability. Telecommunication operators themselves, together with the market trends present significant stakeholders which need to adopt adequate approach to this topic. Enabling organizations to do so, preparing the ground for the upcoming possibilities of efficiently controlling energy usage on wider scope. Ultimately preparing the conditions to run the "smart cities". What do we as a company do ourselves in everyday life to contribute to the overall efforts

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